

SEXUAL BEHAVIOR OF *MURGANTIA HISTRIONICA* (HEMIPTERA:PENTATOMIDAE)

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INTRODUCTION

Murgantia histrionica (Hahn) is an economically important pest of brassiaceous crops in Central and Southern United States. Aspects of its biology have been studied by Paddock (1918), Chittenden (1920), White and Brannon (1933), and Canerday (1965); however, its sexual behavior has not been studied in detail. Therefore, we studied courtship, copulation, polygyny, and polyandry in this bug. Fish and Alcock (1973) and Gamboa and Alcock (1973) have reviewed the literature on pentatomid courtship and copulation.

MATERIALS AND METHODS

In July and August, 1976, nymphs and adults of *M. histrionica* were collected in Washington, D. C. from cabbage, *Brassica oleracea capitata* L.; broccoli, *B. o. cymosa* L.; and radish, *Raphanus sativa* L. Groups of four to seven adult or nymphal bugs were maintained in petri dishes in the laboratory. The laboratory was illuminated with fluorescent light and indirect sunlight, and temperatures varied from 24 to 38° C. Bugs were fed pieces of leaves of *B. o. capitata* or *R. sativa* that were changed about daily. When conspicuous mold appeared on bug feces in petri dishes, bugs were transferred to clean dishes to reduce mortality.

Only virgin adults were used in the study of courtship and copulation to reduce possible behavioral variability due to learned sexual behavior. In each trial of the experiment a male was removed from his dish with forceps and placed in a dish with a female. The female's dish was placed on white paper to provide a good background for observation. Food was removed from a female's cham-

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ber prior to introduction of a male. Males were marked on their scutella with dots of fast-drying, enamel paint so that they could be readily distinguished from females.

In November, 1976, *M. histrionica* were collected from the field for a study of polygamy. Twenty pairs were used, and the bugs may or may not have been virgins. One male and one female were placed with food in each of 20 petri dishes. After a pair copulated, the female was transferred to a dish with a different male. A sample mean is denoted by \bar{X} ; median, M; and size, N.

RESULTS

Fourteen of 20 courtships of *M. histrionica* led to copulation (Fig. 1 and 2). Durations from introduction of a male to copulation initiation ranged from 8.5 to 47.3 min (\bar{X} = 26.8, M = 24.5). Main steps in this bug's sexual behavior are as follows:

(1) The male approaches the female with his antennae waving while she is mobile or immobile. She may become motionless and "crouch down" on the substrate if she is approached when moving, or she may escape and crawl away from the male.

(2) The male antennates the female while she is motionless. If his approach is from her front, he antennates her antennae and then her scutellum. If his approach is from behind, he antennates her posterior abdominal segments and posterior portions of her folded wings. Eighteen antennations lasted from 3 to 15 sec (\bar{X} = 7.0, M = 8.5).

(3) After vigorous male antennation, the female rapidly and violently jerks her body sideways for approximately 3 sec. If the male approaches her from behind, he moves in front of her and antennates her antennae, and then the female shows jerking movements. Females may escape from males during this step in sexual behavior.

(4) The male moves to the female's side, stops, and antennates her side in different places. Antennating males frequently orient approximately 60, 90, 120° with respect to the female longitudinal axis. (Zero degrees is considered to be when the bugs are head to head.) Eleven males used all three orientations and stopped to antennate for from 3 to 5 sec before moving to female posteriors. Females respond to antennation by violent sideways jerking.

(5) When the male reaches the female posterior, he antennates and she shows sideways jerking for from 2 to 5 sec. He strokes the

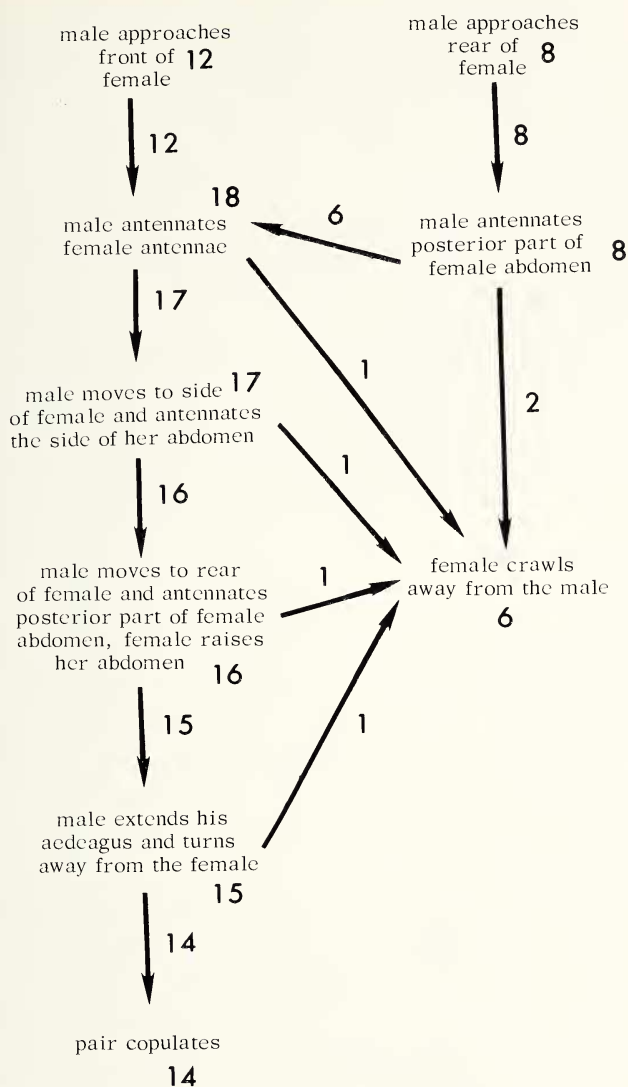


Figure 1. Behavioral sequence in courtship involving 20 pairs of *Murgantia histrionica*. See the text for further explanation.

female venter alternately with his left and right antennae, and then the female raises her abdomen to approximately 30° above the substrate. Females may escape during this step.

(6) With his aedeagus extended, the male makes a 180° turn which maneuvers him into a position from which he initiates linear copulation. Unreceptive females may also escape at this time.

(7) The male elevates his abdomen and backs directly against the female, and he initiates copulation.

(8) Once the pair starts copulating, they use their middle and hindlegs to jerk their bodies up and down. In 14 observations, jerking lasted from 10 to 185 sec ($\bar{X} = 52$, $M = 48$). This behavior also occurred from 5 min to 6 hr after copulation initiation.

(9) The male rapidly strokes up and down the sides of the female abdomen with both his hindlegs. This occurs during and after body jerking. Male leg stroking of the female lasted from 4 to 27 sec ($\bar{X} = 13$, $M = 11$, $N = 14$).

(10) The pair crawls in the petri dish with the female, which is usually larger, pulling the male in most cases. In 71 observation periods, copulating pairs remained motionless from 5 to 1260 sec ($\bar{X} = 453$, $M = 315$). When food was placed in the chamber after several hours of its absence, bugs often fed while *in copula*. Copulation duration ranged from 5.4 to at least 8.3 hr. The termination of copulation was not observed in most pairs.

In petri dishes, a common female escape behavior was quick-crawling to dish sides with the male in pursuit. Females on dish sides continued at steady paces and males followed them with quick-crawling bouts interspersed with rests. Males waved antennae as they approached females. If males reached females, or if females stopped, courtship was hindered because females often escaped when males tried to move in front of them. Females also escaped while males antennated their sides, venters, and when males made 180° turns before aedeagal insertions. Males that were on dish tops or bottoms courted females which were on dish sides, but males did not crawl on dish sides to attain typical positions that occur during copulation initiation. In other situations, two females raised their wings as males approached, and they crawled away as males attempted to court them.

Murgantia histrionica was polygynous and polyandrous in the laboratory. In the polygamy experiment, two males copulated with four different females; four males, with three females; and

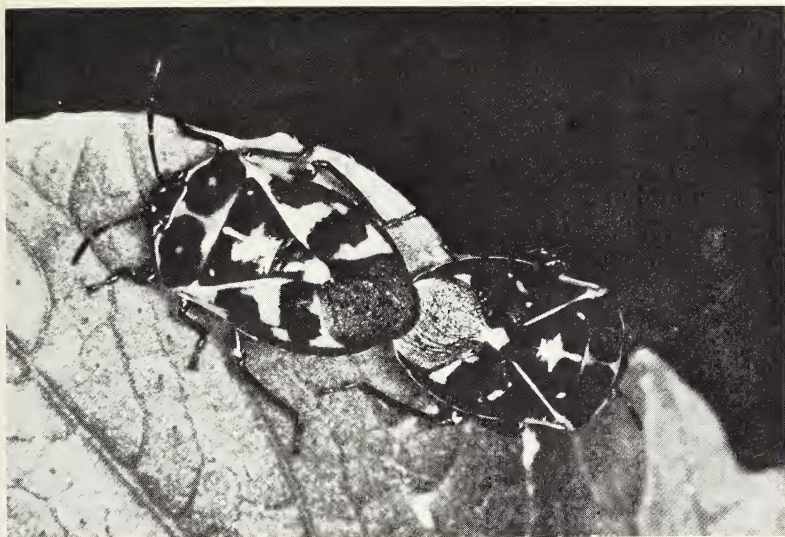


Figure 2. *Murgantia histrionica* in copula on radish foliage. The male faces to the right and lacks part of his right antenna.

two males, with two females. One male copulated once, and 11 other males did not copulate. Two females copulated with three different males; six females, with two males; seven females, with one male; and five females did not copulate.

DISCUSSION

Gamboa and Alcock (1973) reported three major methods by which pentatomids initiate copulation, one of which involves males and females facing in opposite directions, which we found in *M. histrionica*. Fish and Alcock (1973) noted that other species which employ this method have similar courtship behaviors. They listed four main behaviors shared by species of this group: (i) male antennation of the female, (ii) male attempt to lift the female abdomen with his head, (iii) abdominal elevation by receptive females, and (iv) male antennal and aedeagal stimulation of female abdomens. Fish and Alcock conclude that males attempt to induce females to assume positions that facilitate aedeagal insertion. Members of at least six other genera of pentatomids, besides *Murgantia*,

are known to initiate copulation when males and females face opposite directions (Olsen, 1910; Esselbaugh, 1948; Mitchell and Mau, 1969; Alcock, 1971; Fish and Alcock, 1973; and Gamboa and Alcock, 1973).

In *M. histrionica*, male antennation of the female abdomen is followed by female abdominal-raising. Male *M. histrionica* did not attempt to raise female abdomens with their heads as do other males of genera in which bugs initiate copulation while facing opposite directions (Gamboa and Alcock, 1973). In this species, male antennation might be a more derived behavior than male use of heads to raise female abdomens as displayed in other species.

John Alcock (pers. comm.) observed about 25 courting pairs of *M. histrionica* on *Cleome jonesii* (MacBride) Tibestrom (Capparidaceae) on which they also fed, in Patagonia, Arizona, in July 1976. Bug courtship in Arizona was similar to that which we observed, but in addition, males used their abdominal tips to push at and lift female abdomens. Alcock saw many pairs *in copula*; however, none of the observed courtships led to copulation.

As noted above, *Murgantica histrionica* was polyandrous and polygynous in our laboratory study. These behaviors also occur in *Podisus modestus* (Dallas) (Tostowaryk, 1971) and in *Nezara viridula* (L.) (Mitchell and Mau, 1969).

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